Guideline on the declaration of "Additional benefits" and "monetisation of CBA indicators "in the TYNDP 2018 –

CONFIDENTIAL - DRAFT

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Part of the effort to continuously improve the quality of the TYNDP, ENTSO-E will put in place new rules and a new process to:

- ensure a consistent and relevant approach to the definition of additional benefits in the TYNDP 2018 (see definition in Chapter 2 of this document), and
- allow for project promoters to declare alternative values for some indicators not monetised in the CBA 2.0. (referred in this document as 'alternative indicators', see definition in Chapter 3 of this document)

This document provides guidance on how these elements should be declared by project promoters in the TYNDP 2018. The elements presented in Chapters 4 to 6 of this document all apply to transmission and storage projects and to additional benefits and alternative indicators unless specified otherwise.

1. Process

Date	Description
03/05 – 11/05	Inform EC/ACER on the SG decision on approach to additional benefits
11/05	Finalize initial guidance document on identified additional benefits
11/05	Send to EC/ACER guidance document for information
14/05 – 18/05 – 23/05	Additional benefits guidance and approach discussed in the related workshops with promoters
14/05 – 06/06	Collection period of additional benefits, categorized as either: • Previously identified from guidance documents (promoters might or might not provide already monetarization/quantification) • New additional benefit category for consideration (not directly published in the June edition of TYNDP 2018)

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Date	Description
	Additional benefits shall have supporting justification for consideration by ENTSOE in TYNDP
14/05 – 06/06:	Consultation of Draft TYNDP – Projects that have submitted additional benefits that are being reviewed are identified with a standard comment in project sheets
06/06 – 29/06	ENTSO-E works on the outcome of the consultation - Check the additional benefits on 'no objections' basis
2/07 - 16/07	ACER and the EC provide comments on the final version of the Guidance Document
27/07	ENTSO-E shares the final Guidance Document with project promoters (& EC/ACER)
15/09	Project promoters confirm/add additional benefits and provide justification, monetarization, quantification
30/09 (or 31/10 with release of TYNDP for ACER Opinion)	Release of the final additional benefits (all justified/quantified)

2. What are additional benefits?

Additional benefits are all benefits of a project, which may be taken into account in its direct valorisation according to the scope of the TYNDP and not part of the present CBA approved methodology. Hence as a necessary condition an additional benefit does not overlap with the benefits already covered by the present CBA and this condition needs to be proved and justified.

Additional benefits need to comply with the same standards of a benefit that should be covered by the CBA. As such an additional benefit is intended as a benefit to the overall European electricity system (countries in the ENTSO-E Regional Groups). Therefore:

- It does not refer to benefits not directly related to the electricity system
- It does not refer to benefits accruing to non-European countries (that are not in the ENTSO-E Regional Groups perimeter)
- It does not refer to redistribution of income among electricity participants

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Why are some projects benefits not captured or monetised by the CBA?

ENTSO-E is required to produce a TYNDP every two years. This is not a trivial task, and is considered unique internationally in both the scale of its assessment and the level of analysis that it undertakes within these constrained timelines. Whilst each new iteration of the TYNDP has seen significant progress in the factors that are included in the TYNDP and its assessment of the proposed developments it is recognised that such a pan-European analysis has its limitations on the benefits and costs is can assess. The latest evolution of the ENTSO-E Cost Benefit Analysis process recognises these limitations and recommends to further improve these already identified benefits by some additional benefits not captured. That being said, the current guide illustrates what benefits are not yet covered by the current CBA methodology (see section 5).

ENTSO-E therefore accepts for a complete assessment of the benefits and costs of a project that there is a need for additional benefits to be provided outside of the analysis performed directly by ENTSO-E for the TYNDP process.

For the same reasons, an additional benefit must be a benefit that can be assessed according to the specific criteria as presented in Regulation 347/2013 Art. 4, Paragraph 2:

"i) market integration, inter alia through lifting the isolation of at least one Member State and reducing energy infrastructure bottlenecks; competition and system flexibility;

ii) sustainability, inter alia through the integration of renewable energy into the grid and the transmission of renewable generation to major consumption centres and storage sites;

iii) security of supply, inter alia through interoperability, appropriate connections and secure and reliable system operation "

The TYNDP is indeed required in Article 8 of Regulation 714/2009[1] to provide a ten year network development plan. The purpose of this plan is provided in the stated intentions of the regulation:

'In order to ensure greater transparency regarding the entire electricity transmission network in the Community, the ENTSO for Electricity should draw up, publish and regularly update a non-binding Community-wide ten-year network development plan (Community-wide network development plan). Viable electricity transmission networks and necessary regional interconnections, relevant from a commercial or security of supply point of view, should be included in that network development plan.'

This plan required to be consistent with national development plans. The need for a National Development plan is set out in Directive 2009/72/EC2, notably Article 22 which states:

That network development plan shall contain efficient measures in order to guarantee the adequacy of the system and the security of supply.

The purpose for the national development plans and their requirements, and hence that of the TYNDP are set out in the intentions of the directive:

A secure supply of electricity is of vital importance for the development of European society, the implementation of a sustainable climate change policy, and the fostering of competitiveness within the internal market. To that

[1] Link to Regulation 714/2009
[2] Directive 2009/72/EC

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end, cross-border interconnections should be further developed in order to secure the supply of all energy sources at the most competitive prices to consumers and industry within the Community.

It is clear therefore that at it centres the TYNDP development plan and its proposed developments should be focused on benefitting society through more competitive prices, market integration, RES integration, and maintaining security of supply. Additional benefits therefore that can be seen to directly correlate with these objectives, but that are outside of those benefits that the TYNDP is currently able to assess should be considered.

Not all TYNDP projects become candidate to the Projects of Common Interest (PCI) status. However, serving as a relevant input to the PCI selection process is one of the key functions of the TYNDP.

For PCI candidate projects, the declaration of additional benefits is particularly important[3]. In the next PCI selection process, as it is likely that only benefits mentioned in the TYNDP Project Sheets will be considered (n.b: the PCI process is not under the responsibility of ENTSO-E).

Storage projects

The ENTSO-E CBA 2.0 recognises that *"the pan-European models available at ENTSO-E, which are mostly based on TSO grid and market models and used in the CBA, have their limitations when it comes to storage assessment, and some benefits are still not completely captured by the current set of indicators."*

Therefore, the "additional benefits" part of the TYNDP Project Sheets for storage projects is particularly important. The principles and methodologies presented in this document are common to the storage and transmission projects.

3. Monetisation of CBA indicators

ENTSO-E and stakeholders are working with each iteration of the TYNDP towards methodologies for monetisation of as many CBA indicators as possible. Some experimental methodologies, not sufficiently matured to be included in the CBA 2.0, would allow (when proven and properly tested) to provide quantified or monetised versions of indicators in the next CBA.

ENTSO-E has been conducting experimental monetisation studies, notably regarding the Security of Supply indicators. Project promoters may also have conducted their own studies and have access to alternative versions of the indicator.

TYNDP 2018 Project Sheets will include a new box intended for the declaration by project promoters of alternative quantified/monetised values of CBA indicators. This Guidance Document provides a framework for the declaration of this information, by listing which of these indicators are concerned, and providing guidance for the monetisation/quantification.

The principles listed below apply to both 'additional benefits' and "alternative indicators".

4. Principles for the declaration of Additional Benefits and Alternative Indicators in the TYNDP 2018

[3] For reference, and with the knowledge that the approach, scenarios, choices may be entirely different in the next process, Project Promoters may consult the benefits considered in the Proposed methodology for the assessment of candidate projects for the 3rd PCI list,

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In order for additional benefits to be included in the TYNDP 2018 Project Sheets, the following principles should be respected:

- The "Additional Benefits" box in the TYNDP 2018 project sheets is under the responsibility of project promoters, which means that ENTSO-E will not include any element not explicitly provided by the project promoter. However, ENTSO-E keeps the final editorial responsibility.
- ENTSO-E will coordinate the declaration, review and final approval of additional benefits by Project Promoters at different stages of the process according to the process described in this document.
- All declared benefits should **comply with the justification and validation elements** detailed in Chapter 4.a
- Project promoters should be able to **prove the absence of overlapping** with benefits captured in CBA results
- Project Promoters should explicitly **state and quantify which share of the benefits applies to non-EU countries**
- If a project has several project promoters, the claiming of an additional benefits on one of them can be considered. However, the project sheet would specify which project promoter supports the benefits in case of not an agreed claim.

N.B: following the initial consultation period with Project Promoters, this Guidance Document will be updated by ENTSO-E in collaboration with EASE, the EC and ACER. New additional benefits suggested by promoters may be added to the classification, and benefits listed here or the guidance for their declaration and quantification may be modified.

5. Classification and guidance on the monetarisation or quantification

a. Justification and validation

Notwithstanding the specific guidance that is provided in the following section of this document, the following general guidance applies for the justification and validation of additional benefits and alternative indicators.

➔ **Respect the guidance**

Project promoters should declare additional benefits within the classifications provided in this document and respecting the guidance for monetarisation or quantification. These classifications have been accepted as additional benefits by ENTSO-E and EASE and therefore if provided with sufficient justification will be considered applicable. Project promoters should provide due justification if they do not comply with the guidance.

➔ **For additional benefits, provide an external study**

Additional benefits should also be validated by studies recognised by a Regulator, a TSO, or other relevant national body. This recognition is required given the significance of this independent review by an appropriate stakeholder. Benefits not accompanied by an external study will not be considered in the TYNDP unless a sufficient justification for the absence of study is provided.

➔ **Select the best possible data source to justify and quantify indicators**

Promoters proposing and quantifying additional benefits or provide alternative should apply the following prioritisation in selecting the sources of data for their justification analysis:

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1. EU Law
2. National Law
3. ENTSO-E published data (notably for system modelling)
4. EC/Governmental policy, projections and targets
5. European/National Regulatory Policy
6. European Association related to data (i.e. European cost per MW of wind taken from IWEA)
7. Manufacturer related to data (published or written response)
8. Published data
9. Unpublished data

Supporting analysis used to justify additional benefits provided should reference the data sources used.

➔ **Monetise additional benefits whenever possible**

Unless specified otherwise in the lists presented in Chapter 5 of this document, when providing the additional benefit, the promoter should first provide a monetarised value then if this is not possible, that being justified, a quantitative indicator should be provided then only as a last resort a qualitative justification submitted.

b. Scenarios

All benefits should be preferably calculated using the final ENTSOs 2018 scenario datasets published on 30 March 2018 for each scenario considered in the TYNDP2018 process. In case a different scenario is used, it should be explained and justified and ENTSO-E will carefully analyse the acceptance of such approach.

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c. Transmission projects

i. Classification of transmission projects additional benefits and guidance on monetarisation or quantification

Benefit	System Modelling Possible	Explanations on the benefit	Explain why the benefit does not overlap with CBA benefits	Guidance for the monetisation/justification
Reductions of costs for ancillary services	✓	Taking into account ancillary services needs in terms of reserve to control frequency, voltage control resources, black-start, etc… Quantification and monetarisation can derive from specific statistical analyses and simulations of ancillary services amount and their relative costs.	B8 does not cover this benefit. B.8 only deals with giving a qualitative estimation for the transient/voltage/frequency stability effect of new grid investments. No €'s are captured / quantifiable for such indicator, as it does not link to any minimum requirements of quality. B.7 only deals with the optimal balancing energy exchange, which can be linked to EU regulation Electricity Balancing Guideline (EBGL), which requires most countries to adopt & implement cross-border platforms for the optimal exchange of balancing energy. No link is made to balancing capacity costs – neither in B8 nor B7. This "reduction of ancillary services cost" additional benefit, would focus mainly on capacity reservation costs (i.e. cost for reservation/contracting of the reserves, which means these volumes are blocked for usage in other markets) <=> without looking at energy activation costs of ancillary services (which is something we will do for B.7 in CBA 3.0). Some countries today have market based methodology for procurement of these reserves, whereas other simply impose/oblige it's delivery. If the 'dispatch' of these necessary reserves happens on the most efficient	Where ancillary services have been introduced into the market place, they can be modelling in market studies over a year using an appropriate time window i.e. 5 – 15 minutes time steps. By considering the impact with and without a project the net contribution of a project can be monetarised based on what the market has valued this service to be. Where no market value exists for this service capitalisation of EENS may be used to monetarise the benefit. This is restricted to countries where the cost per MWh of lost load is known, and a failure to secure the ancillary service would result in EENS. A non-monetarised quantified value can also be provided showing the value of the ancillary service provision if this has been identified and quantified at a national/synchronous system as a requirement for future operation of the system by the network operator.

			flexibility (generation unit / consumption / ...), welfare contributions are present which can be quantified in €'s.[4] The current time resolution of the studies at a pan-European level in the TYNDP does not allow many of the ancillary service contributions to be calculated and therefore reflected in the benefits. Also currently the range of ancillary services is being extended in many countries beyond those already in existence. Although consideration is being given to how they might be included in some way the existing benefits, they are not presently included.	For some ancillary services market modelling which typically uses a DC based load flow will be insufficient and an AC based approach will be required. Some specialised modelling tools exist which can perform AC market modelling. Alternatively the annual range of dispatches can a significantly reduced into a few representative discrete dispatches and evaluated using a AC network modelling tool. These benefits from these dispatches can be aggregated to also provide a net annual benefit for ancillary service[s].
Reduction of necessary reserve or re-dispatch power plants	✓	Especially for projects able to solve internal congestions. This indicator gives the additional benefit coming from the saved peaking units [in MW] in the system due to the reduction of the maximum redispatch volume with and without the project.	CBA between market nodes, this additional benefit within a market node As the delta AAM for cross-border projects in TYNDP 2018 is given in MWh, for consistency reasons also for internal projects, assessed by the redispatch methodology, this indicator will be given in MWh. On top of this information, this indicator aims for giving the additional information on the saved reserve power	Quantification of the benefit is relative to the reduction of the maximum amount of necessary re-dispatch in MW and can be monetarised by statistical analysis of the costs of reserve from power plants.

[4] Indeed, based on the System Operation Guideline (SOGL), which is a EU regulation that entered into force in September 2017, each TSO should have a certain amount of such ancillary services ("reserves"- eg. FCR (frequency containment reserves), FRR (frequency restoration reserves), or blackstart/reactive power reserves)) available at each moment in time – based on a dimensioning methodology to be respected. This implies that this category of additional benefit has impacts for all TSOs. If certain quality targets are not respected, more reserves will have to be enforced (either procured or mandatory – depending on the country).

The amount of these minimum necessary reserves (as specified in SOGL) + the optimal possible dispatch itself of these contracted reserves (not the activation) within the country (or cross-border) will be influenced by grid investments, hence a certain benefit in €'s is present, but not quantified today (partly because of not being able to have sufficient time granularity in the models to correct model the reserves). Indeed, when cross-border capacity reserve exchange or sharing is performed (as defined in SOGL), welfare benefits are apparent – which are influenced by available grid elements and hence also investments. A simple example: if due to a project, more efficient assets become available, for participation of delivery of these mandatory reserves; benefits are captured – as opposed to when such efficient assets without the project would be blocked for access to the delivery of these reserves, for instance due being localised in a congestion region.

			plants that do not need to be build/allocated in order to cover the needed peaking redisptach power. The redisptach changes the cost-optimal dispatch by exchanging cheaper by more expensive units. Therefore the maximum redisptach power is a direct indication for the need of reserve power plants and the difference (with and without the project) gives a direct indication of the change in needed reserve power plants.	
Reduction of emissions	✓	SOx, NOx, PM 2,5 and PM 10, additional externalities due to COx reductions (CO2 excluded). [5]	Emissions of greenhouse gases, different from CO2, are not considered in the CBA	Resulting from market simulations. Unit is kton of avoided emission per year and the monetarisation is made by using specific prices made available from technical literature (Costs of air pollution form European Industrial facilities 2008-2012 – *study made by EEA*). This indicator is monetarised at the value €/kton valued in the *Stockholm Environmental Institute 2006*. The monetarisation is made using emission factors [ton/MWh] made available from technical literature or published by respected independent bodies.
Impact on independent and reliable control of	✓	For Baltic States Projects making a contribution towards the synchronous operation of the Baltic system with one of the	The CBA-calculations only cover security of supply by use of traditional methods. Hence, security of supply from a geo-political point of view is not covered. Included in this is impact/control of the Baltic	The monetisation may be done related to the ongoing studies between the 4 involved TSOs of the Continental synchronous alternative.

[5] http://www.eib.org/attachments/thematic/economic_appraisal_of_investment_projects_en.pdf

system operation and services (for Baltic States)		European Union networks will contribute to the independent and reliable control of system operation and services. This benefit is monetarised by taking into consideration the avoided cost of a potential blackout.	system from other non-EU countries (Russia) which from a strategic-point-of-view might be critical. Also the relation EU/NATO-Russia is of importance in this discussion.	
Contribution to the removal of infrastructure bottlenecks which are caused by loop flows or transit flows	✓	For projects between the following countries: CZ-DE, DE-PL, DE-NL-BE-LU-FR-DE (identified in the needs evaluation part of the TYNDP). The loop flows are defined as unscheduled flows stemming from scheduled flows within a neighbouring bidding zone or control area. The transit flows are defined as unscheduled flows stemming from a scheduled flow between two or more bidding zones or control areas. Both of these types of unscheduled flows could significantly jeopardize security of the transmission system operation. Therefore it is worth to analyse possible additional benefits which are not covered by the CBA, which are improving the situation by	Several benefits of a projects contribution to the removal of loop or transit flows are already captured in the CBA through the "SEW" indicator – congestion rent and "Variation in losses" indicator – decreasing of losses in the grid. Several studies have listed the costs of loop flows for the European electricity system. In particular a report published by the European Commission[6] lists the main issues related to loop flows: □ *Reduced market efficiency. Grid and generation are not efficiently compensated for what they deliver, and consumers are similarly not exposed to the real cost of the electricity they consume. In addition, the calculated capacities may have little relevance if loop flows dominate. Thus, the resources employed in the power system may not be optimally utilized.* □ *Reduced security of supply. The market is not able to efficiently convey the needs of the physical power system in the form of efficient price signals (incentives) to generators, consumers and grid owners. Sometimes there are not sufficient remedial measures available*	The assessment of a contribution of a project to the removal of loop flows should be done by comparison of market and network flows with and without projects, or by application of generation shift methodologies. Justification is mandatory and quantification welcomed. The monetisation is not foreseen.

[6] https://ec.europa.eu/energy/sites/ener/files/documents/201310_loop-flows_study.pdf, Loop flows – Final advice, THEMA, 2013

		transmission system infrastructure development.	*and system operation under proper security criteria cannot be restored. Failures could then result in black-outs.* □ *Missing incentives and adverse distribution effects. The areas "hosting" physical flows incur costs, and the areas that use other bidding zones to realize their scheduled flows save costs, creating a situation that is perceived as unfair. Limiting the interconnector capacity made available to the market (ATC values) reduces interconnector revenues, and unscheduled physical flows violating security criteria requires implementation of costly remedial measures in host areas (different measures are further described in chapter 3).* Several of these elements are not captured by the TYNDP CBA. Additionally, the same Report concludes that only flow based modelling would allow to fully view the impact of grid development on loop flows.	
Others	As this list have been built based on the additional benefits provided by project promoters in the last PCI list, it is considered that new concepts could arise in this process. They should be clearly defined and described, ensuring compliance with the current guidance and not double counting with other CBA indicators. Proposals Will be collected in a dedicated consultation.			

ii. Alternative monetisation of CBA indicators

In case a benefit is already included in the CBA 2.0 guideline, but a more detailed and sophisticated computation referring to ENTSO-E scenarios / perimeter and/or a proposal of quantification/monetization is presented (where the CBA guideline does not include a proposal for that), this benefit is not an *additional benefit*, but its more accurate computation can be included in the project sheet as a *sensitivity analysis* or an *alternative indicator*.

CBA Indicator	System Modelling Possible	Why it is not quantified/monetised in the CBA	Guidance on the monetisation
B6 indicator: Security of Supply - Adequacy to meet demand	✓	Using the energy not served index computed by means of probabilistic or deterministic network simulations, taking into account several system and network constraints (only limits in transmission capacity among bidding zones is captured in the CBA). The Energy Not Served should be provided in GWh/year and may be monetarised according to the value given to Energy Not Served by customers	Provided by ENTSO-E as sensitivities for a number of projects referring to ENTSO-E scenarios and perimeter. The methodology will be extensively presented in the main TYNDP 2018 report. Results of the indicated or of another method may be provided by project promoter as well if relevant and method transparent.
Monetarisation of B7 indicator Security of Supply – System Flexibility	✓	The CBA indicator B7 (SoS – system flexibility) cannot be monetarised by ENTSO-E for all projects of the TYNDP 2018 using reasonable resources. In addition, it is considered the current definition of the indicator cannot be directly monetized but requires a more detailed computation. A process is ongoing for the next version of the CBA (3.0). As a result, projects promoters who wish to monetarise the indicator may do so according to the following guidance. B7 indicator: The flexibility seeks to capture the capability of an electric system to accommodate fast and deep changes in the net demand (load minus intermittent RES). These changes require more flexible conventional generation to deal with the more frequent and acute ramping-up and ramping-down requirements. Cross-border interconnections support ramping where deviations are balanced over a power system covering a wider area. Transmission capacity thus	⇨ **First Step – Common Platform,** assumed that in the future there will be platforms to exchange balancing energy such as IGCC (now "EU imbalance netting"), TERRE, MARIE, PICASSO. The balancing platforms presuppose that the settlement rules will be harmonised to marginal pricing across different markets, as per TERRE design. The platform also presupposes that there will be standard balancing products to be exchanged. While this is already available for TERRE member states, it can be expected common balancing platforms to be rolled out as part of the balancing guidelines implementation. ⇨ **Second Step- Balancing Need:** assumed that there is a system imbalance that needs to be resolved. The volume needed varies across member states and assumptions would be made about what this would be over the lifetime of the project being assessed. This need is not easy to forecast as generation and

		provides a form of flexibility in the system by increasing the available flexible units that can be shared between different areas (share in reserves). In general, the increase of cross-border capacities between bidding zones through grid development would lead to additional value in terms of balancing energy from frequency restoration reserves and replacement reserves during non-congested time steps. The residual load and the up/down reserves requirements should be assessed as a first step. The available cross-border capacity, which can be used to exchange balancing energy, will be determined and the contribution of the project. The hourly output from the TYNDP market simulations can be used to quantify it.	consumption mix are evolving. An option could be to use historical balancing needs making the assumption that they will apply in the future, as in the TERRE study. The ENTSO-E transparency website provides historic balancing needs. However, as the share of RES in the energy mix and the number of interconnectors is increasing, using historical data risks underestimating future balancing needs. It is strongly recommended to study the effects of this type of assumption. Furthermore, it is acknowledged that a cross-border project could itself increase the balancing needs across to bid areas. ⇨ **Third Step – Cross-border Exchange Capacity**: Determine the available cross-border capacity after market closure, which can then be used to exchange balancing energy. This capacity in both directions will be calculated as an output from the TYNDP market simulations. The simulation results will show the remaining cross-border capacity for every hour in the modelled years (including montecarlo/climatic years). ○ For each platform a dedicated model should be built and updated with spare capacity available with and without the project. ○ Update the spare capacity taking into account what will be left after each platform simulation. ⇨ **Fourth Step – Opportunity for Imbalance Netting:** Determine the opportunity for imbalance netting between control areas. The opportunity for imbalance

			netting in one direction does not require available cross-border capacity and can be achieved even if the link is fully congested for market flows. In situations where imbalance netting requires flows in the same direction as market flows, there is need for available cross-border capacity. The model should calculate the volume of imbalance netting that is possible. ⇨ **Fifth step – Balancing Bids and Offers:** Establish the balancing bid price stack for the different balancing markets. There are currently four proposals to determine this with increasing levels of complexity. i) Determine a seasonal average balancing bid price using historical data ii) Determine hourly national balancing bid price curves, ie price and volume offered, using historical data iii) Determine historical balancing bid price savings exchanged through TERRE (or other such platform) iv) Determine hourly national balancing bid price curve, ie costs and volume offered, using forecast data that reflects changes to generation mix (taking into account the technologies available for participating in the balancing market) ⇨ **Sixth Step - Balancing Cost Savings.** For imbalance netting, the cost savings will be calculated as the difference of the balancing costs with and without the

			project.

d. Storage projects

i. Classification of storage projects additional benefits and guidance on monetarisation or quantification

Benefit	System Modelling Possible	Explanations on the benefit	Explain why the benefit does not overlap with CBA benefits	Guidance for the monetisation/justification
Reductions of costs for ancillary services	✓	Taking into account ancillary services needs in terms of reserve to control frequency, voltage control resources, black-start, etc… Quantification and monetarisation can derive from specific statistical analyses and simulations of ancillary	B8 does not cover this benefit. B.8 only deals with giving a qualitative estimation for the transient/voltage/frequency stability effect of new grid investments. No €'s are captured / quantifiable for such indicator, as it does not link to any minimum requirements of quality. B.7 only deals with the optimal balancing energy exchange, which can be linked to EU regulation Electricity Balancing Guideline (EBGL), which requires most countries to adopt & implement cross-border platforms for the optimal exchange of balancing energy. No link is made to balancing capacity costs – neither in B8 nor B7. This "reduction of ancillary services cost" additional benefit, would focus mainly on capacity reservation costs (i.e. cost for reservation/contracting of	Where ancillary services have been introduced into the market place, they can be modelling in market studies over a year using an appropriate time window i.e. 5 – 15 minutes time steps. By considering the impact with and without a project the net contribution of a project can be monetarised based on what the market has valued this service to be. Where no market value exists for this service capitalisation of EENS may be used to monetarise the benefit. This is restricted to countries where the cost per MWh of lost load is known, and a failure to secure the ancillary service would result in EENS. A non-monetarised quantified value can also be provided showing the value of the ancillary service provision if this has been identified and quantified at a national/synchronous system as a requirement for future operation of the system by the network operator. For some ancillary services market modelling which typically uses a DC based load flow will be insufficient and an AC based approach will be required. Some specialised modelling tools exist which can perform AC market modelling. Alternatively the annual range of dispatches can a significantly

		services amount and their relative costs.	the reserves, which means these volumes are blocked for usage in other markets) <=> without looking at energy activation costs of ancillary services (which is something we will do for B.7 in CBA 3.0). Some countries today have market based methodology for procurement of these reserves, whereas other simply impose/oblige it's delivery. If the 'dispatch' of these necessary reserves happens on the most efficient flexibility (generation unit / consumption / ...), welfare contributions are present which can be quantified in €'s.[7] The current time resolution of the studies at a pan-European level in the TYNDP does not allow many of the ancillary service contributions to be calculated and therefore reflected in the benefits.	reduced into a few representative discrete dispatches and evaluated using a AC network modelling tool. These benefits from these dispatches can be aggregated to also provide a net annual benefit for ancillary service[s].

[7] Indeed, based on the System Operation Guideline (SOGL), which is a EU regulation that entered into force in September 2017, each TSO should have a certain amount of such ancillary services ("reserves"- eg. FCR (frequency containment reserves), FRR (frequency restoration reserves), or blackstart/reactive power reserves)) available at each moment in time – based on a dimensioning methodology to be respected. This implies that this category of additional benefit has impacts for all TSOs. If certain quality targets are not respected, more reserves will have to be enforced (either procured or mandatory – depending on the country).

The amount of these minimum necessary reserves (as specified in SOGL) + the optimal possible dispatch itself of these contracted reserves (not the activation) within the country (or cross-border) will be influenced by grid investments, hence a certain benefit in €'s is present, but not quantified today (partly because of not being able to have sufficient time granularity in the models to correct model the reserves). Indeed, when cross-border capacity reserve exchange or sharing is performed (as defined in SOGL), welfare benefits are apparent – which are influenced by available grid elements and hence also investments. A simple example: if due to a project, more efficient assets become available, for participation of delivery of these mandatory reserves; benefits are captured – as opposed to when such efficient assets without the project would be blocked for access to the delivery of these reserves, for instance due being localised in a congestion region.

			Also currently the range of ancillary services is being extended in many countries beyond those already in existence. Although consideration is being given to how they might be included in some way the existing benefits, they are not presently included.	
Reduction of emissions	✓	SOx, NOx, PM 2,5 and PM 10, additional externalities due to COx reductions (CO2 excluded). [8]	Emissions of greenhouse gases, different from CO2, are not considered in the CBA	Resulting from market simulations. Unit is kton of avoided emission per year and the monetarisation is made by using specific prices made available from technical literature (Costs of air pollution form European Industrial facilities 2008-2012 – *study made by EEA*). This indicator is monetarised at the value €/kton valued in the *Stockholm Environmental Institute 2006*. The monetarisation is made using emission factors [ton/MWh] made available from technical literature or published by respected independent bodies.
Reduction of necessary reserve or re-dispatch power plants	✓	Especially for projects able to solve internal congestions. This indicator gives the additional benefit coming from the saved peaking units	CBA between market nodes, this additional benefit within a market node As the delta AAM for cross-border projects in TYNDP 2018 is given in MWh, for consistency reasons also for internal projects, assessed by the redispatch methodology, this indicator will be given in MWh. On top of this information, this indicator aims for giving the additional information on	Quantification of the benefit is relative to the reduction of the maximum amount of necessary re-dispatch in MW and can be monetarised by statistical analysis of the costs of reserve from power plants.

[8] http://www.eib.org/attachments/thematic/economic_appraisal_of_investment_projects_en.pdf

		[in MW] in the system due to the reduction of the maximum redispatch volume with and without the project.	the saved reserve power plants that do not need to be build/allocated in order to cover the needed peaking redispatch power. The redispatch changes the cost-optimal dispatch by exchanging cheaper by more expensive units. Therefore the maximum redispatch power is a direct indication for the need of reserve power plants and the difference (with and without the project) gives a direct indication of the change in needed reserve power plants.	
Others		As this list have been built based on the additional benefits provided by project promoters in the last PCI list, it is considered that new concepts could arise in this process. They should be clearly defined and described, ensuring compliance with the current guidance and not double counting with other CBA indicators As this list have been built based on the additional benefits provided by project promoters in the last PCI list, it is considered that new concepts could arise in this process. They should be clearly defined and described, ensuring compliance with the current guidance and not double counting with other CBA indicators. Proposals Will be collected in a dedicated consultation.		

ii. Alternative monetisation of CBA indicators

In case a benefit is already included in the CBA 2.0 guideline, but a more detailed and sophisticated computation referring to ENTSO-E scenarios / perimeter and/or a proposal of quantification/monetization is presented (where the CBA guideline does not include a proposal for that), this benefit is not an *additional benefit*, but its more accurate computation can be included in the project sheet as a *sensitivity analysis* or an *alternative indicator*.

CBA Indicator	System Modelling Possible	Why it is not quantified/monetised in the CBA	Guidance on the monetisation
B6 indicator: Security of Supply - Adequacy to meet	✓	Using the energy not served index computed by means of probabilistic or deterministic network simulations, taking into account several system- and network constraints (only limits in transmission capacity among bidding zones is captured in the	Provided by ENTSO-E as sensitivities for a number of projects referring to ENTSO-E scenarios and perimeter. The methodology will be extensively presented in the main TYNDP

demand		CBA). The Energy Not Served should be provided in GWh/year and may be monetarised according to the value given to Energy not Served by customers	2018 report Results of the indicated or of another method may be provided by project promoter as well if relevant and method transparent..
Monetarisation of B7 indicator Security of Supply – System Flexibility	✓	The CBA indicator B7 (SoS – system flexibility) cannot be monetarised by ENTSO-E for all projects of the TYNDP 2018 using reasonable resources. In addition, it is considered the current definition of the indicator cannot be directly monetized but requires a more detailed computation. A process is ongoing for the next version of the CBA (3.0). As a result, projects promoters who wish to monetarise the indicator may do so according to the following guidance. B7 indicator: The flexibility seeks to capture the capability of an electric system to accommodate fast and deep changes in the net demand (load minus intermittent RES). These changes require more flexible conventional generation to deal with the more frequent and acute ramping-up and ramping-down requirements. Cross-border interconnections support ramping where deviations are balanced over a power system covering a wider area. Transmission capacity thus provides a form of flexibility in the system by increasing the available flexible units that can be shared between different areas (share in reserves). In general, the increase of cross-border capacities between bidding zones through grid development would lead to additional value in terms of balancing energy from frequency restoration reserves and replacement reserves during non-congested time steps. The residual load and the up/down reserves requirements should be assessed as a first step. The available cross-border capacity, which can be used to exchange balancing energy, will be determined and the contribution of the project. The hourly	⇨ **First Step – Common Platform,** assumed that in the future there will be platforms to exchange balancing energy such as IGCC (now "EU imbalance netting"), TERRE, MARIE, PICASSO. The balancing platforms presuppose that the settlement rules will be harmonised to marginal pricing across different markets, as per TERRE design. The platform also presupposes that there will be standard balancing products to be exchanged. While this is already available for TERRE member states, it can be expected common balancing platforms to be rolled out as part of the balancing guidelines implementation. ⇨ **Second Step- Balancing Need:** assumed that there is a system imbalance that needs to be resolved. The volume needed varies across member states and assumptions would be made about what this would be over the lifetime of the project being assessed. This need is not easy to forecast as generation and

		output from the TYNDP market simulations can be used to quantify it. The value of some ancillary services is highly locational and no markets exist to date, namely voltage control, this service can be extremely valuable and storage units can provide these services through their PCS or their generators operated as syncrhonous condensers. Power flow models should taked into account the operation of storage for this service and should estimate a volume Mvarh per year. Monetising this element should be informed by ACER as most contracts for reactive power are bilateral and confidential. Since this is a service that is highly locational and with limited access to new parties the value is expected to be high. The deployment of storage reduces the need for regulation capacity by providing fast responding resources and in some cases by providing synchronous inertia. Regulation capacity is remunerated by an availability fee and these costs might not be currently modelled. By reducing the amount of regulation capacity requirements storage can reduce the cost to operare the system.	consumption mix are evolving. An option could be to use historical balancing needs making the assumption that they will apply in the future, as in the TERRE study. The ENTSO-E transparency website provides historic balancing needs. However, as the share of RES in the energy mix and the number of interconnectors is increasing, using historical data risks underestimating future balancing needs. It is strongly recommended to study the effects of this type of assumption. Furthermore, it is acknowledged that a cross-border project could itself increase the balancing needs across to bid areas. ⇨ **Third Step – Cross-border Exchange Capacity**: Determine the available cross-border capacity after market closure, which can then be used to exchange balancing energy. This capacity in both directions will be calculated as an output from the TYNDP market simulations. The simulation results will show the remaining cross-border capacity for every hour in the modelled years (including montecarlo/climatic years). ○ For each platform a dedicated

			model should be built and updated with spare capacity available with and without the project. ○ Update the spare capacity taking into account what will be left after each platform simulation. ⇨ **Fourth Step – Opportunity for Imbalance Netting:** Determine the opportunity for imbalance netting between control areas. The opportunity for imbalance netting in one direction does not require available cross-border capacity and can be achieved even if the link is fully congested for market flows. In situations where imbalance netting requires flows in the same direction as market flows, there is need for available cross-border capacity. The model should calculate the volume of imbalance netting that is possible. ⇨ **Fifth step – Balancing Bids and Offers:** Establish the balancing bid price stack for the different balancing markets. There are currently four proposals to determine this with increasing levels of complexity. i) Determine a seasonal average balancing bid price using historical

			data ii) Determine hourly national balancing bid price curves, ie price and volume offered, using historical data iii) Determine historical balancing bid price savings exchanged through TERRE (or other such platform) iv) Determine hourly national balancing bid price curve, ie costsand volume offered, using forecast data that reflects changes to generation mix (taking into account the technologies available for participating in the balancing market) ⇨ **Sixth Step - Balancing Cost Savings.** For imbalance netting, the cost savings will be calculated as the difference of the balancing costs with and without the project.
Alternative indicator of CBA benefits better captured with time granularity of the models (15 minutes steps for storage projects	✓	*The granularity of the models foreseen by the CBA 2.0 is 1h and does not cover very important details that can be captured with 15 minutes granularity.*	A marginal approach on some specific days simulated with a 15 minutes step within the TYNDP scenarios is recommended to quantify and monetise these benefits.

<table>
<tr><td>instead of 1h step foreseen in the CBA)</td><td></td><td></td><td></td></tr>
<tr><td>B6:Security of supply– Adequacy to meet demand: alternative indicator to quantify avoided investments in peaking capacity</td><td></td><td>More clarity around how the Additional adequacy margin can be monetised in terms of avoided installation of spare capacity is needed. The text in CBA 2.0 reads : „The 'Additional adequacy margin' is measured in MW of spare capacity that does not need to be installed as a result of expanding transmission capacity. It can be conservatively monetised on the basis of investment costs of peaking units, although this may not be appropriate if the share of the additional adequacy margin compared to the installed generation base is relatively large. In this case a specific analysis is required for the monetization of the additional adequacy margin“

A storage unit would reduce the need to invest in additional peaking units and possibly required infrastructure within its respective bidding zone. Additionally, it can create benefits to interconnected bidding zones. Monetizing the avoided cost to invest in peaking capacity in the respective zone seems not to be considered.

The following table illustrates the issue:

<table><tr><th>Required installed capacity</th><th>Area A</th><th>Area B</th><th>System</th></tr><tr><td>Without interconnection& storage</td><td>800 MW</td><td>800 MW</td><td>1,600 MW</td></tr><tr><td>With energy storage but no interconnector. 100 MW energy storage and suitable duration to guarantee EENS</td><td>700 MW</td><td>800 MW</td><td>1,500 MW</td></tr></table></td><td>The indicator is computed by means of deterministic or probabilistic simulations, running market model for several climate years and maintenance planning (ideally stochastic optimization). The indicator is monetarized based on the cost new entry</td></tr>
</table>

		level				
		With an interconnector but no storage. A 100 MW interconnector assuming adequate generation and demand profiles between bidding zones	700 MW	700 MW	**1,400 MW**	
		With storage and interconnectors decribed above	600	700	**1, 300 MW**	
		Additional adequacy margin with storage and interconnector	200 MW	100 MW	**300 MW**	
		Given the dependency of Additional Adequacy Margin on compatibility of demand and generation pattern among bidding zones, it is advisable to model this through probabilistic means.				

6. Collection of additional benefits

Project promoters should declare the additional benefits for their projects using the TYNDP online platform.

For each additional benefit, the project promoter will need to feel the following form:

- Category of the benefit in the classification (or other)
- Valorisation
    - Monetarised value [MEuro]/year
    - If not possible Quantified value - mention also the unit e.g. [MWh]
    - If not possible Qualitative information (concise)
    - Justification for the absence of monetarised value
- Justification
    - Which share of the benefit addresses EU countries?
    - Name of the study the value above resulted from
    - Main assumptions of the study (copy the relevant text here and include the reference page and chapter)
    - Who has conducted the study
    - Year of the study
    - Study horizons - the years the study looked into
    - Did any national authority approve the study?
    - Link to the study. Upload option of the report is not public

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